

Vol. I
TRANSCRIPT OF RECORD

(Pages 1 to 534)

Supreme Court of the United States

OCTOBER TERM, 1951

No. 428

**PENNSYLVANIA WATER AND POWER COMPANY
AND SUSQUEHANNA TRANSMISSION COMPANY
OF MARYLAND, PETITIONERS,**

vs.

FEDERAL POWER COMMISSION ET AL.

No. 429

**PENNSYLVANIA PUBLIC UTILITY COMMISSION,
PETITIONER,**

vs.

FEDERAL POWER COMMISSION

**ON WRITS OF CERTIORARI TO THE UNITED STATES COURT OF
APPEAL FOR THE DISTRICT OF COLUMBIA CIRCUIT**

PETITIONS FOR CERTIORARI FILED NOVEMBER 16, 1951

CERTIORARI GRANTED FEBRUARY 4, 1952

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Joint Appendix.

[1] BEFORE THE
FEDERAL POWER COMMISSION

In the Matter of:
PENNSYLVANIA WATER & POWER } Docket No. IT-5915
COMPANY }

Hearing Room
Federal Power Commission
Hurley-Wright Building
1800 Pennsylvania Avenue, N. W.
Washington, D. C.
Monday, April 15, 1946.

The above-entitled matter came on for hearing pursuant to notice at 10:00 o'clock A. M.

Before: EWING G. SIMPSON, Trial Examiner.

Appearances:

F. G. AWALT,
RAYMOND SPARKS,
DARYAL A. MYSE and
P. C. KING, JR., of Hewes and Awalt, 822 Connecticut Avenue, N. W., Washington, D. C.; and
GEORGE T. HAMBRIGHT, Lancaster, Pennsylvania; and
GEORGE ROSS HULL, Harrisburg, Pennsylvania; and
JOHN C. KELLEY, Harrisburg, Pennsylvania,
appearing for Pennsylvania Water & Power Company and Susquehanna Transmission Company of Maryland.

E. M. STURTEVANT and

CLARENCE W. MILES, Baltimore, Md., appearing for Consolidated Gas, Electric Light and Power Company of Baltimore.

SAMUEL G. MILLER, Harrisburg, Pennsylvania, appearing for the Pennsylvania Public Utility Commission.

[2] ROBERT FRANCE, General Counsel, Public Utilities Commission of Maryland.

SIMON E. SOBELOFF, City Solicitor of Baltimore; and

THOMAS J. TINGLEY, Assistant City Solicitor of Baltimore.

HOWARD E. WAHREN BROCK, Assistant General Counsel; and

REUBEN GOLDBERG, appearing on behalf of the Staff of the Federal Power Commission.

[3] PROCEEDINGS.

TRIAL EXAMINER: The hearing will be in order.

The hearing in Docket IT-5915 in the matter of Pennsylvania Water & Power Company set for this hour and date in this hearing room is called to order.

This is a hearing upon an Order of the Commission dated September 1, 1944, entitled "Order Instituting Investigation", and upon an Order of the Commission dated October 3, 1944, entitled "Supplemental Order Enlarging Investigation".

[12] TRIAL EXAMINER: On November 9, 1945, the Commission entered an order in the matter of Pennsylvania Water & Power Company in Docket IT-5915 entitled "Order Fixing Date of Hearing", a copy of which I hand the Reporter at this point for inclusion in the record as if read.

[16] TRIAL EXAMINER: Likewise, the Commission entered an Order in this matter and Docket dated December 11, 1945, entitled "Order Postponing Hearing". A copy of this Order is now handed to the Reporter for inclusion in the record as ~~is~~ read.

. . .

[18] TRIAL EXAMINER: On January 24, 1946, the Commission issued an Order entitled "Order Further Postponing Hearing", a copy of which I hand the Reporter at this point for inclusion in the record as if read.

. . .

[20] TRIAL EXAMINER: On March 19, 1946, the Commission entered a further Order entitled "Order Further Postponing Hearing" in which it was provided that the hearing in the above-entitled matter now set for March 25, 1946, and the same is hereby postponed to April 15, 1946, at 10:00 o'clock A. M. in the hearing room of the Federal Power Commission, Hurley-Wright Building, 1800 Pennsylvania Avenue, Northwest, Washington, D. C.

A copy of this Order is handed to the Reporter for inclusion in the record at this point as if read.

. . .

[22] TRIAL EXAMINER: I also hand the Reporter for inclusion in the transcript at this point a copy of designation of Trial Examiner signed by the Honorable Leland Olds, Chairman, under date of April 3rd, 1946, which designation is to be incorporated in the record at this point.

. . .

[24] TRIAL EXAMINER: In connection with the designation, it should be said that by virtue of the Commission's standing order of September 30, 1941, the Commission's Chief Trial Examiner is authorized to join the presiding Trial Examiner on the bench and preside jointly with him or in his stead in this proceeding whenever it may seem necessary or desirable to do so.

By Order dated January 9, 1946, entitled "Order Permitting Intervention" the Commission ordered that the Pennsylvania Public Utility Commission be and it was thereby permitted to become an intervenor in this proceeding.

A copy of this Order is handed the reporter for inclusion in the record at this point.

. . .

[26] TRIAL EXAMINER: On February 6, 1945, the Commission entered an Order entitled "Order Permitting Intervention" which ordered that the Public Service Commission of Maryland be and was thereby permitted to become an intervenor in this proceeding.

A copy of this Order is handed to the Reporter for inclusion in the record at this point.

. . .

[28] TRIAL EXAMINER: On March 27, 1945, the Commission entered an Order in this matter and Docket entitled "Order Permitting Intervention" whereby it permitted the Consolidated Gas Electric Light and Power Company of Baltimore to become an intervenor in this proceeding, subject to the rules and regulations of the Commission, provided, however, that the admission of such intervenor shall not be construed as recognition by the Commission that Petitioner might be aggrieved by any Order or Orders of the Commission entered in this proceeding.

A copy of this Order is handed to the Reporter for inclusion in the record at this point.

. . .

[30] TRIAL EXAMINER: I will ask counsel to state at this time what notice has been given of this proceeding.

MR. GOLDBERG: Mr. Examiner, I have examined the formal files of the Commission and I am able to state that all interested parties, including the Mayor and City Council of Baltimore, the County Commissioners of Baltimore County, the Bethlehem Fairfield Shipyard, Incorporated,

the Public Service Commission of Maryland, Rustless Iron & Steel Corporation, Susquehanna Transmission Company of Maryland, Consolidated Gas Electric Light and Power Company of Baltimore, the Governors of the States of Maryland and Pennsylvania, the Pennsylvania Public Utility Commission and Safe Harbor Water Power Corporation, among others, have been served with copies of all of the Orders the Trial Examiner has had incorporated in the record as though read preceding my statement.

I ask at this time that those notices be incorporated in the record by reference. I believe all of them appear in Part I of the Commission's Formal Files of the Pennsylvania Water & Power Company, Docket IT-5915.

TRIAL EXAMINER: Without objection, that will be done.

[33] **TRIAL EXAMINER:** Pursuant to the letter addressed to the Pennsylvania Water & Power Company by the Acting Secretary of the Commission under date of November 16, 1945, the Order of Procedure at this hearing will be for the Pennsylvania Water & Power Company to proceed first with the presentation of its evidence; for the Susquehanna Transmission Company of Maryland, the Consolidated Gas Electric Light & Power Company of Baltimore, Pennsylvania Public Utility Commission, Public Service Commission of Maryland and the Staff of the Federal Power Commission to follow with the presentation of their evidence in the order named.

I will now call upon counsel for the Pennsylvania Water & Power Company to briefly state his position with reference to the issues involved in this proceeding, and the evidence which he proposes to present.

MR. SPARKS: May it please Your Honor, we first take an exception to Your Honor's ruling that we be required to proceed first, and will state, also, that in proceeding in accordance with Your Honor's ruling we do not waive the right to make any point, or to raise any question which we deem appropriate in the proceeding.

Furthermore, may I say that while we do have a conception of certain of the issues in this case, it must be recognized that we have not been advised of the positions or the contentions of any of the other parties.

[34] So, as a result, we are more or less stabbing in the dark on the issues. There are or may be issues of which we have no knowledge.

In accordance with Your Honor's ruling, however, we are prepared to state certain of the issues which we believe to be present in the case, and I shall proceed to do so.

First: This Commission has no jurisdiction over the rates, charges and classifications, of Pennsylvania Water & Power Company under Part II of the Act, for the reason that the Company is to be treated as a licensee and may be considered to be a purchaser of power from a licensee for use in public service, and is, therefore, subject to Part I of the Act only. Since the record does not show that the two states involved, namely, Maryland and Pennsylvania, are unable to agree, through their properly constituted authorities on the services to be rendered or on the rates or charges of payment therefor by Pennsylvania Water & Power Company, the Commission has no jurisdiction under Part I.

Second: If the Commission has any jurisdiction over any of the rates, charges, and classifications of the Respondents for the transmission or sale of electric energy at wholesale, it has jurisdiction only over the rates, charges, or classifications for such transmissions or sales which are in interstate commerce.

Third: The Commission has no jurisdiction, under Part II, [35] over any of the rates, charges, or classifications for the services rendered by Pennsylvania Water & Power Company and Safe Harbor Water Power Company [Corporation] to Consolidated Gas Electric Light & Power Company of Baltimore, since none of such rates, charges, or classifications, are for transmission of electric energy, or for the sale of electric energy.

Fourth: The Commission has no jurisdiction, under Hart II, over any rates, charges, or classifications for any services rendered to Pennsylvania Railroad Company, since such services do not involve a sale of electric energy at wholesale.

Fifth: The Commission has no jurisdiction to determine and fix by Order any division of rates or charges to be received by Pennsylvania Water & Power Company for services rendered jointly with others.

Sixth—and may I say, Your Honor, as to the last point to which I have adverted, except for point number 6, which goes to the question of the hearing relating to jurisdiction, so far as any other issues may be present on the merits of such issues. We do not know what the contentions are or may be, so that I would ask Your Honor to consider that in considering the last point which I make.

Sixth: The requirement that Respondents proceed first in the presentation of evidence without being informed of the issues and contentions of the other participants and of the Staff of the Commission representing the Government, [36] deprives the Respondents of the fair hearing required by the Federal Power Act and by the due process clause of the Fifth Amendment to the Constitution of the United States.

Seventh: And lastly, the rates, charges and classifications made, demanded, received, observed, charged, and collected by Pennsylvania Water & Power Company by itself and jointly with others, and the rules, regulations, practices, and contracts affecting such rates, charges, and classifications are now lawfully in force under the laws of the United States and of the State of Pennsylvania, are not unjust, unreasonable, unduly discriminatory or preferential, and are, therefore, not unlawful.

Therefore, until the other participants, including the Staff of the Commission, make their position and conten-

tions clear on the record, we are unable to determine what other issues are involved.

. . .

[37] **TRIAL EXAMINER:** Just one moment. Does counsel at this time have any statement as to the evidence that he proposes to submit?

MR. SPARKS: I want to comply with Your Honor's ruling, and state that we do have evidence pertaining to the history, and general evidence which will be presented by Mr. Walls, the president of the company. We shall present evidence pertaining to the contracts for consideration of the Commission; and, such other evidence as we feel should meet the contentions which may be made, and which will be made, that we think are consistent with the issues as we now see them.

TRIAL EXAMINER: The Examiner is correct in his interpretation of your opening statement as having been made also on behalf of the Susquehanna Transmission Company of Maryland?

MR. SPARKS: Yes, sir, that is correct.

. . .

MR. GOLDBERG: I have noted here that one of the reasons assigned for the challenging of the Commission's jurisdiction [38] is that the Commission has, in brief, no jurisdiction to determine the fixing of the division of rates which are the result of services rendered jointly; is that correct?

MR. SPARKS: That is correct.

MR. GOLDBERG: I do not know of any reason in connection with that challenge to the Commission's jurisdiction having been stated. I am wondering if I had missed it, or whether counsel had stated one.

MR. SPARKS: I stated, if Your Honor please, that the Commission has no jurisdiction to determine the division of joint rates. The reason, briefly, for that contention is that, unlike the Interstate Commerce Act, and perhaps some

other acts, the Federal Power Act contains no language which may be conceived to give to the Federal Power Commission power over the divisions of revenues as between persons who render services jointly.

• • •

[39] TRIAL EXAMINER: The Pennsylvania Public Utility Commission?

MR. MILLER: We have no statement to make.

TRIAL EXAMINER: Public Service Commission of Maryland?

MR. FRANCE: Mr. Examiner, the Public Service Commission of Maryland is primarily concerned with the allocation to Maryland of its proper share of any rate reduction. At the proper time we wish to put on the stand as our witness, Mr. Paul L. Holland, the Chief Engineer for the Commission, who will testify as to what we believe the percentage allocation to Maryland should be.

TRIAL EXAMINER: Staff counsel for the Federal Power Commission?

MR. GOLDBERG: Mr. Examiner, at the outset I would like to say that I think I have listened very carefully to the statement made by counsel for the Respondents. I think it fair to state that the Respondents are, of course, aware of their position, as to rate base, depreciation, both annual and accrued, and other elements of this rate case.

I have concluded, however, and I think fairly so, that for [40] some reason they have seen fit not to divulge their position as to those matters at this time.

However, the Staff of the Commission does not take a position such as that, and will at this time divulge its position on the various elements of the rate case.

It is the intention of the Commission's Staff in this proceeding to present evidence on the components of a rate case, including rate base, depreciation, working capital, and rate of return, and the like.

[41] Before outlining the staff's present contentions in regard to the various elements of this rate case, I think it might be well to describe in brief and general terms, Pennsylvania Water and Power Company and its operations.

This also includes, of course, the Susquehanna Transmission Company of Maryland.

For the sake of brevity, I will refer to the Pennsylvania Water and Power Company as "Holtwood".

Holtwood owns and operates a steam electric and a hydroelectric plant located on the Susquehanna River at Holtwood, Pennsylvania. To fix the location more graphically, it is about eight miles below the Safe Harbor Water Power Corporation's project, and about eight miles above the Conowingo project on the same river. Holtwood also owns and operates a transmission system, directly and indirectly. That part of the transmission system which is located in Pennsylvania, it owns and operates directly. That part lying within the boundaries of the State of Maryland, it owns and operates indirectly, for legal reasons, through a wholly owned corporation, Susquehanna Transmission Company of Maryland, the other Respondent in this case. Susquehanna's transmission system is administered by Holtwood through operating agreements, and is coordinated with the properties directly owned and operated by Holtwood, and is operated as a unit by a common organization. [42] Holtwood sells electric energy at wholesale, in bulk, to public utility companies, leaving to its customer companies, by deliberate choice, the distribution of that electric energy at retail. Holtwood and its customer-public utilities companies operate in a thickly-populated, rich agricultural and highly developed industrial area which is second to none in the United States.

Holtwood, Mr. Examiner, unlike the majority of electric companies in this country, by reason of its contractual arrangement with its principal customer, Consolidated Gas and Electric and Power Company of Baltimore, (sic) is very fortunately situated. That contract, in

effect, insures to Holtwood net operating revenues, independent of the amount of output, and increasing as additional plant investment is made. Under that contractual arrangement a relatively fixed amount representing the return to Holtwood is determined. That return is computed upon two principal factors, first, the amount of earnings during the year 1930; and, second, a fixed percentage on the net additions to plant since 1930, less an adjustment for increases in the depreciation reserves since 1930.

To this return Holtwood adds all operating expenses, power purchases, depreciation expenses and deducts the revenues collected from its customer companies other than the Baltimore Company—and by “Baltimore Company”, I mean, of [43] course, the Consolidated Gas Electric [Light] and Power Company of Baltimore. In short, this contractual arrangement constitutes virtually a guarantee of earnings on Holtwood's capital stock. Based upon its present capital structure and present agreement with Consolidated, the rate is about 20 per cent.

Briefly, taking up the various elements upon which the Commission's staff will offer evidence,—I think at the outset I might state that the staff's plans at present do not include the presentation of evidence on the form of the contract. This, of course, does not mean that the Commission may not change, or is not at liberty to make such changes as it may see fit, based upon the evidence of record; nor, does it mean that those who are proposing to offer testimony on that aspect of the case should not do so.

On the matter of rate base, it is the staff's position that actual legitimate investment is the appropriate rate base in this case, and that reproduction cost testimony, trended original cost testimony, or any such testimony, usually presented to show the alleged fair value of the properties devoted to public service, should be rejected and not received in evidence if offered here.

Now, with respect to this investment rate base, it is the position of the staff that the gross investment for the

rate base is, in round figures, \$32,920,738. This is, in round numbers, \$5,663,494 less than Holtwood's book figures, which the staff [44] contends contain write-ups. The staff proposes the elimination of the \$5,663,494 because the staff contends that such amount does not represent actual cost, and should be disallowed. The staff's evidence will, of course, develop the details of the eliminations and the reasons therefor.

With regard, now, to the matter of depreciation, the staff will also show an analysis of the Holtwood's depreciation practices and methods which it has recorded on its books, used in its power bills, and reported in its tax returns to the Bureau of Internal Revenue.

The staff does not propose to recommend to the Commission that Holtwood be required to change from the straight line method of depreciation it has always been using.

The staff has made service life and depreciation studies to test to the reasonableness of the annual depreciation charge and the accrued depreciation. The staff contends that the annual depreciation expense is \$465,000, and that the reserve requirement is about \$8,204,770. Although this reserve requirement is somewhat less than the reserve per books, it is the position of the staff, for reasons that will be developed, that the present book reserve is not excessive, and should be used in reaching a net rate base in this case.

The staff will, also, present evidence on the appropriate amount of working capital that should be allowed in this case, and that amount is in the neighborhood of \$600,000. There [45] will also be presented analyses of the company's operating expenses, balance sheets, income statements, and other pertinent financial data. In that connection, the staff proposes to take exception to certain operating expenses, and will also present analyses of the company's past earnings, which will show that the company has earned at least ten per cent rate of return on its net investment, including working capital during its entire period of operations.

On the subject of rate of return the staff will present data which will enable the Commission to reach a proper determination as to the fair rate of return.

The staff has made a study to determine the reasonableness of the cost of service to the customers served under demand and energy contracts. This study involves allocations of cost to each customer, including the allowance for return. It is expected that this cost allocation to the individual customers will serve as a guide to the Commission in arriving at the reasonable rates to be charged to those customers. Testing the staff's conclusions, it appears that at a rate of return of five per cent the indicated rate reduction is \$2,450,000.

I might state here that the figures I have spoken of on the record are as of December 31, 1945.

One more thing and I am through. It will be recalled that at the outset I stated that I would sketch the staff's "present [46] position," on the various aspects of the case. I use the adjective "present" deliberately. The staff has made a comprehensive investigation of all the elements of this case. We believe that, as a result of that investigation, it has gathered and considered all of the material and relevant facts which are necessary to reach a proper and just result.

If, perchance, though I think it unlikely, the staff has not considered all of the material and relevant evidence which the company may have in its possession, and expects to present in these proceedings, the consideration of which evidence would alter the conclusions reached by the staff, the staff would want the opportunity to revise its position in the light of that evidence, to the extent required.

More than that, it would insist upon that opportunity, because it is not the purpose of the staff to adhere to a position, come what may. The staff has approached this investigation in that spirit. It is in that spirit that it enters this hearing and intends to continue throughout the proceedings.

TRIAL EXAMINER: The Examiner has before him two other orders which will be entered into the record at this time. One is the order of April 5, 1946, denying further postponement of the hearing, which was entered upon consideration of the application of the Public Service Commission of Maryland, filed April 4, 1946 for the postponement of the hearing in [47] the above-entitled matter for a period of sixty days. The Examiner will direct the Reporter to spread that out on the Record at this point.

. . .

[48] **TRIAL EXAMINER:** Also, an order of April 5, 1946, entitled "Order Denying Petition". This is an order "Upon consideration of the 'Petition for specification of Issues and Reconsideration of Direction Fixing Order of Procedure' filed April 3, 1946, by Pennsylvania Water & Power Company and Susquehanna Transmission Company of Maryland."

The Examiner now directs the Reporter to incorporate this order in the Record at this point.

. . .

[52] **JOHN A. WALLS,**
was called as a witness by and on behalf of the Respondents, and, being first duly sworn, testified as follows:

DIRECT EXAMINATION.

By MR. HAMBRIGHT:

Q. Will you please state your full name and your business address? [53] **A.** John A. Walls, 1611 Lexington Building, Baltimore, Maryland.

Q. Mr. Walls, will you please state what official employment or other connection you have had with the Pennsylvania Water and Power Company and the Safe Harbor Water Power Corporation, and what other experience you have had with similar hydroelectric developments? **A.**

Following graduation from the Massachusetts Institute of Technology in 1899 with the degree of Bachelor of Science in Electrical Engineering—* * * I was employed by Wallace C. Johnson, Consulting Engineer, at Niagara Falls, for a period of about two years on the engineering phases of hydroelectric development in the United States and Canada. In 1901 I went with the Shawinigan Water and Power Company, which had been organized about 1898, and became its chief engineer in 1905, which position I retained until I was called to Holtwood in 1909, continuing for a period as consulting engineer to Shawinigan Water and Power Company.

[54] I maintained for years first-hand acquaintance with the affairs of Shawinigan Water and Power Company, and have been at one time or another a director in that company and in companies in the fields of industry, street railway operation and electricity and gas distribution.

I have been a director in a corporation doing large scale financing of electric and gas utilities in foreign countries, and was a partner for a number of years in the firm of Aldred & Company, which did investment banking. In recent years, my directorships with all business corporations, other than the Pennsylvania Water & Power Company and certain subsidiaries, have been terminated. The Shawinigan development was a pioneering undertaking in Canada which began about 1902 or 1903, the delivery of bulk power to Montreal over a 90-mile long high tension transmission line.

I believe that the general range of experience in large scale hydroelectric engineering on this continent from the beginning of the century will be found to be represented in the several plants of the Shawinigan Water & Power Company, which company has contributed much to the development of the hydroelectric art.

November 1st, 1909 I came down to the Susquehanna River in the employ of Mr. J. E. Aldred, who had been made receiver of the McCall Ferry Power Company. The

McCall Ferry Power Company was reorganized as the Pennsylvania Water & Power [55] Company in January 1910, and I served as its chief engineer until 1914. The dam and plant at Holtwood were completed and have since been operated under my personal supervision. From 1914 until December 1933, I was vice-president and chief engineer of the Pennsylvania Water & Power Company, and since that date its president. I have been a director of this company from the early days of its organization.

I was vice-president of the Safe Harbor Water Power Corporation from its organization until 1933 when I became its president, and was a director from the early days of its organization. I resigned as president and director October 23, 1940 and have now no official connection with it.

Pennsylvania Water & Power Company owns one-half of the voting common stock, Class 'B', of Safe Harbor Water Power Corporation, for which it paid \$3,000,000.

I had served years on the Hydraulic Power Committee of the National Electric Light Association, am a Fellow of the American Institute of Electrical Engineers and am a Member of the American Society of Civil Engineers.

I have done consulting work on hydroelectric developments in Canada and in the United States. On a number of occasions I have had the opportunity to make detailed studies of the hydroelectric industry in certain foreign countries, have visited and made engineering reports on many hydroelectric plants in France, Italy and elsewhere and became acquainted [56] there with the outstanding personnel of the industry. In addition, Aldred & Company, of which I had been a partner for some years, had European correspondents which kept the firm continuously advised of the progress of hydroelectric engineering in Europe.

Q. Will you please outline briefly the preliminary work and events leading up to and including the construction of the Holtwood Dam, the organization of the Pennsylvania

Water & Power Company, the beginning of its business, and the first two decades of its history.

• • •

THE WITNESS: Investigation of the water power possibilities of the Susquehanna River in the reach of the lower 40 miles from tidewater to Columbia, began prior to 1905. Different promoters and engineers did a greater or less amount of preliminary work on projects along this reach. From the records in possession of the company, it was not until 1905 that major construction work on any of these schemes was actually initiated. In that year the McCall Ferry Power Company was [57] formed and work was started on the so-called McCall Ferry (now Holtwood) dam at Fry Island.

However, in 1907 following the failure of the Knickerbocker Trust Company of New York, the McCall Ferry Power Company found itself unable to procure the necessary funds for continuing construction as planned and had to curtail work with the dam and power house only partly finished.

The records of the company also disclose that efforts were made by interests representing the stocks and bonds to carry on the work thereafter. Little was accomplished, however, owing to the difficulty of raising money in this country for major construction projects during the months following the Knickerbocker Trust Company failure. That bank failure was followed by a so-called money panic, characterized by the partial suspension of specie payments by banks in this country and by the absence of a satisfactory market for new issues of securities. Funds became no longer available for interest on the outstanding bonds.

McCall Ferry Power Company had to struggle in this situation with a plant, interrupted in the construction stage, which had suffered a financial set-back, thereby being to a certain extent discredited for the future as respects ability to carry out power contract commitments. The unfinished plant represented a new departure in low head

hydroelectric plants because of its magnitude, its geographical setting close to the [58] coal fields and because of the then undeveloped state of the art of design and operation of low-head hydro plants for use on a river of highly fluctuating flow.

Certain interested security holders in 1908 approached Mr. J. E. Aldred, who had pioneered in the construction and operation, as well as in the financing and business conduct of a large hydroelectric development at Shawinigan Falls on the St. Maurice River in Canada, sending power over a long distance, high tension, transmission line to Montreal. After surmounting many difficulties, he had brought that undertaking to a position of technical and financial success and of promising growth. It is today a great and successful enterprise. He had learned first-hand of the many difficulties then surrounding the pioneering of a large scale hydroelectric development and had demonstrated ability to contend with those difficulties. He was invited to visit the site of the work and agreed to take charge of the project, to assume the burden of raising the money necessary to complete it, to head the company, to build up a company staff, to carry on the construction work, to make power contracts for its output, to get it into operation and to put it on its feet as a business enterprise. There followed a brief period of receivership under him, beginning in 1909 and terminating early in 1910.

At the end of 1909 the property of the McCall Ferry Power Company consisted of real estate and riparian rights, the [59] foundation and most of the superstructure of a dam, leaving to be built the abutments at each end of the dam and, to be filled in, the gaps in the dam superstructure through which the Susquehanna River was being diverted. The foundation and a portion of power house superstructure had been erected, and the tailrace was in usable condition. Engineering studies and plans, construction buildings and construction plant were also at hand. The status of the work at that time included the results

of expenditures made during the period of receivership. Some transmission line right-of-way had been acquired, but no transmission lines or substations had been built and practically no machinery had been installed.

• • •

[60] Q. The witness is shown photograph marked for identification as Exhibit 1 and I ask him to state what that exhibit shows. A. Exhibit 1 is a photograph of the exterior of the power house and dam showing the stage of construction at about the end of 1909.

Q. The witness is shown the photograph marked for identification as Exhibit 2 and asked to state what that exhibit shows. A. Exhibit 2 is a photograph of the exterior of the power house from upstream at about the same time.

Q. The witness is shown photograph marked for identification as Exhibit No. 3 and asked to state what that exhibit shows. [61] A. Exhibit 3 is a photograph of the inside of the power house also at about the same time.

[62] Q. Mr. Walls, will you continue with the discussion of the organization and early history of the Pennsylvania Water and Power Company? A. On January 13, 1910, the Pennsylvania Water and Power Company (hereafter called Penn Water), a Pennsylvania corporation, was formed as a reorganization of the McCall Ferry Power Company, succeeding to the property and rights of the former company. Somewhat prior to this time, the receiver of the McCall Ferry Power Company, Mr. J. E. Aldred, had engaged the services of the Empire Engineering Corporation to proceed with the construction work at Holtwood.

It was urgent to rush the work so that before the end of the year the project might be sufficiently near to a demonstration to potential power customers, of its technical and financial practicability. For negotiation of power contracts with the latter, this demonstration was considered highly desirable before they might make additions to their own

generating plants involving capital charges and stand-by operating costs which might make the value of hydro supply to them and the revenue therefor less than it would be otherwise. The work necessary included procurement of generating units and transformers, their installation and preliminary operation; sufficient additions to the power house structure and dam to permit this, together with the purchase and installation of auxiliary equipment. The [63] rights-of-way had to be acquired for a transmission line, a double circuit transmission line built thereon between Holtwood and Baltimore, and a terminal substation had to be built at Baltimore. All this was a major engineering task for that period.

The construction work was pushed ahead with speed and by the end of 1910 the reorganized Company had largely completed the 55 feet high, 2392 feet long, gravity concrete dam; the first of the generating units was tested out and trial operation was initiated; the balance for the forty-mile-long transmission line right-of-way from the power house to Baltimore had been obtained; and a substation had been partially finished in Baltimore.

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[67] Because of doubt as to the right of Penn Water, as a Pennsylvania Corporation, to own and operate transmission lines and substations in Maryland, a Maryland Corporation, Susquehanna Transmission Company of Maryland, was organized for such purpose. It was formed in April, 1910, by the consolidation of Susquehanna Pole Line Company of Harford County and Susquehanna Pole Line Company of Baltimore County, both of which had been incorporated in 1907. All of its securities outstanding are owned by Penn Water. When Penn Water is referred to by me, it includes as part thereof the Susquehanna Transmission Company of Maryland.

While the construction work was being driven ahead, efforts were being made to find customers in Pennsylvania,

Maryland and Delaware, negotiations being had with power users in Philadelphia, York, Lancaster, Reading, Harrisburg, Wilmington and elsewhere. On August 29, 1910 a contract was entered into with the Consolidated Gas Electric Light and Power Company of Baltimore for a period of ten years. In February, 1911, a 15-year contract was obtained with the United Railways & Electric Company of Baltimore.

By 1914 eight units had been installed in the Holtwood hydroelectric plant and in 1924 the final two hydroelectric units had been put into service, occupying the last space available in the present power house and bringing the [68] effective capacity of the plant up to 104,000 kilowatts, approximately fifty per cent greater than previously contemplated, without any major additions to the hydraulic structures. A steam-electric generating plant was built at Holtwood in 1924 and 1925, to use river coal dredged from the pond above the dam. Transmission lines had been built from Holtwood to the cities of Baltimore, Lancaster, Coatesville and York, to deliver electric service to electric utilities distributing in the regions adjacent thereto.

Thus, prior to 1930 the Company found itself with a hydroelectric and a steam development, with transmission lines radiating to principal load centers and supplying power to other utilities whose requirements had been growing rapidly.

Q. Mr. Walls, will you please continue the discussion of the Penn Water's initial period and some of its then problems which gave rise to continuing policies of the company?

A. Not only was speed of construction a requirement in the initial period of the reorganized Company, but there were two other important factors given attention, viz: that the construction work should be well done to assure permanency and that the work be carried out at the lowest possible cost consistent therewith, but avoiding frills and non-essentials. One of the settled policies of the Company

ever since has been [69] to endeavor to make major plant extensions at times of low construction cost indices and when labor is more efficient, for charges associated with plant cost, bulk large in hydro generating plants as compared with steam plants. Because of the early financial history of the project, it was desirable that operating and overhead costs be kept to the minimum to put Penn Water in financial position to obtain the additional amounts of money later to be required for extensions and to put it on a dividend paying basis with the least delay.

Hydro power had not at that time established itself in this territory as a desirable and dependable supply. The ability of the plant to withstand the floods and ice shoves of the river was questioned. The question of the reliability of long transmission lines and their terminal facilities, and the effect of low river flow added to the distrust of the undertaking.

The technical difficulties involved in the construction and operation in those early years of this large hydroelectric plant with its steel tower transmission lines, were great, and the service at the outset was not as good as desired. Such service if continued unduly would, it was felt, prejudice the marketing of the then novel hydroelectric supply. The problems which arose as a consequence of the lack of knowledge on the part of manufacturers as how to meet the growing and [70] stiffening requirements of Penn Water to secure the desired reliability of service and also the high quality of service as respects maintenance of system frequency, responsiveness of governing, etc., caused much worry to the technical force of Penn Water in the early days.

For a long period I was continually planning from year to year as to what possible improvements might subsequently be made in the service or value of the hydro supply to meet competition and to increase the earnings of the Company. It was essential that hydro service should gain a sufficiently high reputation for quality of service

promptly and maintain that reputation with the minimum of deviations therefrom.

[72] The type of power supply contract common with sustained high flow hydroelectric plants such as was used prior to 1910 in Canada and at Niagara Falls, where power was generally sold in blocks on practically a sustained horsepower-year basis, was totally unsuited to the Holtwood plant conditions, the latter involving the use of a river subject not only to seasonal but also to sudden and wide fluctuations in flow and lying in a territory adjacent to supplies of coal.

It came to be appreciated that base load energy of sustained or block form, obtainable by operating the most modern and efficient portion of a customer's steam generating equipment at high use factor, established a so-called "Operating Production Cost" per kilowatt-hour for such block which was exclusive of capital and other pertinent charges. This base load kilowatt-hour cost was quite different from and lower than the average cost of generating by steam the entire load of that customer which varies from hour to hour and from week to week. The average cost of the base load energy was in turn much lower than the cost of generating on the peaks of the load, the latter requiring the retention of and at times the use of relatively inefficient older steam [73] generating equipment of the customer.

The various power contracts of Penn Water show a development along the lines of coordinating the hydro supply with the steam generating potentialities of the Company's customers. This was accomplished by provisions for the inter-changing of steam and hydro energy and for increasing the carrying by hydro of the peak portions of the customers' loads which cost those customers most per kilowatt-hour to generate, as well as supplying base load energy during periods of ample flow.

It was also found that hydro supply gave opportunities for benefit to the customers by deferring their steam plant extensions, thus making a saving to the customers in capital and other pertinent charges and permitting the later purchases of more modern steam equipment.

To get adequate prices for its power, Penn Water must ever try to give service that is of the highest quality. The direct, as distinguished from the also important indirect, financial penalties for failure in supply were and still are important special elements of risk to Penn Water, as, for example, that risk appearing in Article VII, first paragraph of the Safe Harbor contract, whereby Penn Water is obligated to purchase and pay for Baltimore Company's entitlement of the Safe Harbor output in the event it should fail in its duty to transmit the same to the Baltimore Company. [74] There were several circumstances in 1910 which stood in the way of arranging power agreements with possible customers of Penn Water that would enable the best utilization of the hydro resources inherent in the Susquehanna River.

Chief of these was the lack of a fundamental understanding of the principles and methods of coordinating hydro power from a run of the river project with the steam resources of surrounding utilities, which utilities should form the logical outlet for the new development. Consideration of such problems by prospective customers was handicapped by the fact that the reliability of continuous operation of a large hydroelectric plant with a dam spanning a stream such as the Susquehanna, subject to floods and ice, had not yet been established. Neither had the reliability been proven in this locality of high-tension transmission of electricity by steel-tower lines over a distance of 40 miles, utilizing transformers at both ends of the line, and extending through a territory subject to frequent lightning storms during a part of the year and to sleet storms during another part of the year.

Up to 1910 few large hydroelectric developments existed in northeastern United States with long distance transmission of power in bulk. Though there were at Niagara Falls, large plants where the river flow was ample throughout the year, transmission was of limited scope, and the initial loads were largely furnished by nearby industrial plants. [75] Holtwood's supply was distant from its prospective markets, greatly fluctuating in amount, and requiring for full economic success of the enterprise, the eventual disposal of a greater amount of energy than could be then absorbed in any one practicable market. At that time, for electrochemical uses, a constant supply of very cheap hydro was a desideratum, not the varying supply available from Holtwood.

For industrial uses it had been the custom to look upon hydro as an individual or sole supply competitive with steam rather than to be coordinated with steam. Some hydro plants had been built adjacent to mill installations for the local sale or use of electrical or mechanical power in small quantities. It was against a background of such a limited conception of hydro service that Penn Water had to sell its particular character of bulk supply in the initial years of the reorganized company.

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[77] The result was that the fullest coordination of the facilities of Penn Water and of its customers in the interest of the economical utilization of the power potentialities of the power pool to meet most adequately the integrated requirements of the pool for the final benefit of the ultimate consumer, was not effected until the present contractual arrangements were devised in 1931.

The first major step to that end was taken in 1921 when Penn Water and its two customers in Baltimore agreed to the coordinated use of hydro supply on the combined instead of the separate loads of the two Baltimore companies. The 1911 contract between Penn Water and the Railways Company was superseded by transferring to

the Consolidated Gas Electric Light and Power Company the responsibility for the furnishing of electric service to the Railways Company.

At that same time, Consolidated Gas was given a participating entitlement in the power and energy production of Penn Water. Hydro supply could, under that arrangement be used to better advantage than formerly, but subsequent experience [78] proved that there were still impediments to the most effective coordination for maximum system economy.

An effort was made in 1927 at the expiration of the 1921 agreement between Penn Water and Consolidated Gas to perfect the contractual arrangements for achieving the complete coordination of the hydro and steam resources of the two companies. The participating entitlement in the power and energy production of Penn Water which had been granted to the Consolidated Gas in the 1921 agreement, was readopted, and additional provisions were added for the purpose of facilitating the desired coordination of resources at that time and in future planning.

However, the practice of the classification of power and energy and the use of demand and energy charges with fixed unit rates, which had been earlier evolved in the utility field in connection with the sale of blocks of power, uncomplicated with the problem of coordination of resources of the buyer and seller of hydro-steam supply, was continued in the 1927 agreement and still militated against the correct principles of operating a combined hydro-steam generating and supply system.

It was not until further contractual arrangements had been made in 1931 by which Consolidated Gas' payments to Penn Water and Safe Harbor Company were placed on the basis of an annually computed lump sum, independent of the number of kilowatts and kilowatt hours, that the last contractual obstacle [79] disappeared and the most economical result obtainable from the combined power resources could be derived.

In 1913, the Edison Electric Company of Lancaster, Pennsylvania, which later on became the property of the Pennsylvania Power & Light Company, contracted for a supply from Holtwood, and in 1923 supply to the utilities in York and Coatesville, Pennsylvania, was initiated.

The latter are now parts of the systems of the Metropolitan Edison and the Philadelphia Electric Companies, respectively.

The size of the loads of these utilities was relatively small in comparison to that of the Baltimore utilities, but there were good reasons for thinking that their loads would develop in time. Such growth did occur with them as well as in the case of the Baltimore utilities, so that by 1929 it was realized that the potentialities of the Holtwood plants were almost fully realized.

[82] MR. GOLDBERG: In that connection, I would like to inquire of Respondents' counsel what is claimed with respect to the date of commercial operation of Holtwood project?

MR. SPARKS: I do not see that it is particularly relevant at this stage of the proceedings, Mr. Examiner. We will at the proper time put on evidence with respect to that matter.

[91] [THE WITNESS]: Another contribution of Penn Water is found in the intrinsic design of the Safe Harbor plant which permits its output to be integrated with that of Penn Water for overall benefit, and the hydro resources of the two companies to be combined using the transmission and interconnection facilities into which they flow, to best advantage of the region served by the companies.

[93] MR. GOLDBERG: Mr. Examiner, I hesitate to interrupt, but I just wonder if we are trying the Safe Harbor case all over again. I cannot fathom the material-

ity or relevancy of these contributions of Penn Water that it is alleged to have made to the Safe Harbor project.

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[94] THE WITNESS: Coincident with the arrangements for the ownership of the Safe Harbor plant, Penn Water and Consolidated Gas supplemented and coordinated their existing power supply agreement with provisions that would permit the output of the Safe Harbor plant to be brought into the regional electric supply system in a way that would facilitate pooling it with the product of the hydro and steam plants at Holtwood, and with the output of other steam plants in the system, with the aim of producing the maximum overall economy of operation and reliability of service.

[108] GEORGE WHITTIER SPAULDING,
a witness called on behalf of the Respondents, being first duly sworn, testified as follows:

[109] DIRECT EXAMINATION.

By MR. MYSE:

Q. Will you please state your full name? A. George Whittier Spaulding.

Q. You are a vice-president of the Pennsylvania Water & Power Company, are you not? A. Yes, sir.

Q. Do you hold a position with the Safe Harbor Water Power Corporation? A. Yes, as Advisory Engineer.

Q. Are you an officer of the Susquehanna Transmission Company of Maryland? A. No, I am not, but as vice-president of Pennsylvania Water and Power Company I also act as Advisory Engineer of the Susquehanna Transmission Company of Maryland, a wholly owned subsidiary of Pennsylvania Water & Power Company.

Q. What has been your professional training and experience? A. I graduated from the Massachusetts Institute of Technology with a degree of Bachelor of Science in Electrical Engineering in 1921.

Following short periods of employment with the Westinghouse Company of Boston, the Plymouth Electric Light and Power Company of Plymouth, Massachusetts, and the Century Electric Company in St. Louis and Boston, I returned to the Massachusetts [110] Institute of Technology as instructor and laboratory assistant, pursuing at the same time several graduate courses in hydroelectric developments and power transmission.

In June 1923 I was employed by the Union Electric Light and Power Company in St. Louis, Missouri, as engineer in its transmission and distribution department, and in 1924 I entered the employ of the Pennsylvania Water and Power Company and have been with that company continuously to date, being employed successively as test engineer, assistant chief of tests, and assistant to the general superintendent, to January, 1938, when I became assistant chief engineer of both the Pennsylvania Water and Power Company and the Safe Harbor Water Power Corporation.

In August 1942 I was made superintendent of power of the Pennsylvania Water & Power Company, and advisory superintendent of power of the Safe Harbor Water Power Corporation, and in 1943 was promoted to vice-president of the Pennsylvania Water & Power Company.

I am a member of the American Institute of Electrical Engineers, the American Society of Civil Engineers, and a registered professional engineer in the State of Pennsylvania and Maryland.

Q. What have been your general duties and responsibilities with the company in recent years? A. Between 1931 and 1938 I was engaged in power market [111] studies and contract negotiations, under the direct supervision of the general superintendent and vice-president of Pennsylvania Water & Power Company.

Let me say that I shall hereafter refer to Pennsylvania Water & Power Company as Penn Water, and shall refer to the Susquehanna Transmission Company of Maryland as Steco [STCo], shall refer to the Safe Harbor Water

Power Corporation as Safe Harbor and shall refer to the Consolidated Gas Electric Light and Power Company of Baltimore as the Baltimore Company.

During this period from 1931 to 1938 I was actively working on power contracts which were negotiated with the Pennsylvania Railroad Company for the supply of power to the railroad's proposed electrification in Maryland, and in that portion of southeastern Pennsylvania in the general vicinity of Penn Water power development at Holtwood and the hydroelectric development of Safe Harbor at Safe Harbor, Pennsylvania.

Although Baltimore Company also became a party to this railroad contract, the principal negotiations and power supply arrangements were made by the two hydro companies, Penn Water and Safe Harbor.

Following the initial contract with the Pennsylvania Railroad Company in 1931, negotiations were opened with the Potomac Electric Power Company in Washington, D. C., in collaboration with the Baltimore Company, for the supply of [112] hydro peak service, the necessary transmission services being provided by Penn Water and its Maryland subsidiary, Steco [STCo].

Although the final contract was made between the Potomac Electric Power Company and the Baltimore Company, the late Mr. F. A. Allner, then vice-president of Penn Water, initiated the negotiations and completed them as a special representative of the Baltimore Company.

I was closely associated with Mr. Allner in all of these negotiations.

Shortly after the service under this power supply contract with Potomac Electric Power Company had been inaugurated, a supplemental contract was negotiated with the Pennsylvania Railroad Company by Penn Water and Safe Harbor, providing among other things to supply power to the Maryland Division of the railroad at Washington, through facilities which were to be provided by the Potomac Electric Power Company.

With the extension of the transmission facilities of Penn Water and those of its Pennsylvania customers in the middle 30's, negotiations were carried out by Penn Water leading to closer coordination of the power resources of itself and these northern companies, resulting in a continued parallel operation and in interchange of power and energy.

In the system planning power market studies, Penn Water initiated and took the leading part in bringing together the [113] several independent interests as parties to resulting interconnection contracts.

Beginning about 1938, I took a more leading part in such negotiations, and since 1942 all power market studies and arrangements for the coordination of the operations of Penn Water with its customer companies have been made under my direction.

Through the recent war period, close coordination of operations and system planning were most essential in the war effort, both to obtain the fullest use of installed capacity capabilities of the interconnected system and to arrange for the interchange and diversion of hydro and steam energy on the interconnected systems to accomplish the conservation of oil in the early years of the war and of coal in the latter years as critical fuel shortages arose.

Q. Was it necessary for Penn Water to make new contracts to carry out such coordination and diversion of energy during the war years? A. No. The existing contracts of Penn Water had, through the years, been developed to recognize the advantages to be gained through such coordinated operations, and they contained sufficiently flexible provisions to permit the accomplishment of such coordination even under load conditions that could hardly have been foreseen at the time the contracts were entered into.

[114] It has been the continuing practice of the companies' management in contract negotiations to endeavor to provide through its power contract terms: first, for the proper

incentive to accomplish maximum over-all economies for all parties;

Second: To provide for an equitable division of the savings resulting from such an operation; and

Third: To interpose a minimum of artificial barriers to the most economical method of operation.

Q. Mr. Spaulding, does Penn Water dispose of all of its electric power and energy in bulk as distinguished from local distribution? A. Yes, ever since the incorporation of Penn Water in 1910 it has disposed of its power and energy in bulk to other utilities, and except for a limited amount sold to its wholly owned subsidiary during World War I. It has never attempted to develop local distribution systems nor to enter upon a retail distribution business, nor has it attempted to compete with its other utility customers for bulk power industrial customers.

[115] It has never sought nor does it have any substantial monopolized distribution territory.

Q. What has been the basis of its power contracts with its present customers? A. Penn Water, as a wholesaling company, has always had to compete with other sources of supply available to its customers, all of whom have had their own power generating resources or were able to obtain such supply from other adjacent utilities.

Its power contract charges have therefore been determined on a competitive basis, and it has had to meet existing or potential competition which has changed from time to time with new developments and improved methods of power generation.

The guiding principle of Penn Water's management has been to fully develop the natural resources of the Susquehanna River in its reaches occupied by the Holtwood and Safe Harbor power developments, to integrate its potentialities of hydro and steam electric power and energy, of equipment and of such special facilities and operations as Penn Water and later Safe Harbor could offer, so as to promote the most efficient and effective use

of their own facilities and operations with those of their respective customers, to mutual advantage.

Their customer requirements have not been uniform, either as between such customers, or from decade to decade, [116] and the contractual terms which have resulted are, therefore, found to differ widely.

However, they all reflect in one way or another the services which are inherent in the hydro resources of the Susquehanna River, the interconnection facilities which have been extended, and the results of coordinated operation which the company has fostered and developed.

Q. Mr. Spaulding, will you explain more fully how the hydro resources of the Susquehanna River have been developed by Penn Water? A. Penn Water is in the unique position of being the only non-captive wholesaling utility company in the United States.

Its power resources are largely hydro. The services which it was able to render to its utility customers in the first decade of its incorporation were not completely understood by, or acceptable to, these customers, in part because of the skepticism as to reliability of service from its run-of-river plant with the widely fluctuating flows experienced on the Susquehanna River, delivered over what was then considered to be a long distance transmission line, and in part because the advantages of coordinating hydro and steam resources were not fully appreciated.

Hydro power to that time had almost always been sold on the basis of a horsepower year, with industries purchasing [117] a specified amount of power—measured in terms of horsepower—to be used for as many hours a year as needed.

As a result, there was little, if any, opportunity or incentive to realize the full potentialities of a fluctuating stream flow at a run-of-river plant under such arrangements.

Where additional hydro capacity was installed, the additional energy available with higher flows had to be sold

on a "when, as and if" basis. The terms "primary" or "firm power" and "secondary" or "interruptible power" were evolved during these early stages of hydro development.

These terms have since largely lost their significance through the increased recognition of the advantages of coordinating "hydro" and "steam" resources of two or more independent companies through the vehicle of power contracts.

Penn Water's early experience indicated that the load requirements of two or more customers could and should be combined in operating practice for the purpose of utilizing the available hydro supply to the best advantage and later this principle was extended to include the utilization of the steam resources of several of its customers to the mutual advantage of the contracting parties.

Q. Mr. Spaulding, have you prepared an exhibit to indicate in a graphical manner the advantages of operating the hydro resources of the Susquehanna River on the interconnected system with which these hydro plants are presently operated? [118] A. Yes, I have.

MR. MYSE: Mr. Examiner, I ask to have identified as Exhibit No. 8, a document entitled "Coordinated Use of Hydro Resources on the Interconnected System."

TRIAL EXAMINER: The document may be marked for Identification as Exhibit No. 8.

(The document referred to was marked Exhibit No. 8 for Identification.)

By MR. MYSE:

Q. Will you please describe and explain this exhibit?
A. This exhibit consists of three parts—two charts for each of three calendar days.

The horizontal scale on each of the six charts represents the time of the day, starting in each instance at midnight.

The vertical dimension on the three upper charts indicates the magnitude of the total interconnected system load at any time, or the amounts of generation by various component parts of the system, while the vertical dimension on the lower three charts indicates the amounts of installed hydro capacity or amounts of hydro capacity operating at various times of the day.

Referring first, to the three upper charts, the heavy black curve shows graphically the sum of the interconnected system load requirements of Baltimore Company, including the total load of the Bethlehem Steel Company, one of its major [119] industrial customers, the load requirements of Penn Water's other firm power customers, together with the load requirements of the Pennsylvania Railroad, supplied by the several sources in a manner to be described later.

The specific calendar days chosen for this Exhibit, and then shown thereon, are typical of current experience and are here used for illustrative purposes.

The two charts shown on the left of the exhibit, are for a March day in the current year; the two in the middle of the exhibit are for a heavy load day in December of last year; and the two charts on the right are for the peak load day of 1945.

Three days were selected for materially different amounts of usable stream flow in the Susquehanna River available to both the Holtwood and Safe Harbor plants.

The stream flow for the March day, shown at the left, was actually 125,000 cubic feet per second which was greater than the powerhouse draft of either the Safe Harbor or Holtwood hydroelectric plants.

The stream flow for the day shown in the middle of the exhibit was actually 19,200 cubic feet per second, approximating the average usable flow at these plants for all months of November and December, in which months the maximum system load requirements have occurred.

It was desired to illustrate the type of operation [120] required with very low stream flow by the two charts at the

right, but, because of high flow through 1945, no recent low flow experience was available under present load conditions.

Consequently, such operation has been illustrated by an estimated division of the generation for the actual peak load day of 1945, by using as the weekly average flow 5,800 c. f. s., which flow will be exceeded about 95 per cent of the time in the months of December.

Q. Will you explain generally how the operations of the individual hydro and steam plants are scheduled for these different river flow conditions? A. The objective of the Power Production Departments of the Hydro Companies may be said to be the generation of the power and energy necessary to supply the requirements of the combined system load in the most efficient and effective manner.

This end can only be accomplished through the collaboration of the system dispatchers of the several independent power system involved.

Careful advance estimating is required on an annual, weekly and daily basis, of the expected river flows, of the expected system load requirements and the need for capacity.

Estimates must also be made of the desired operating reserve capacity or spinning reserve which must be available [121] as protection against unpredictable load increases, including the short-time swings in such loads that develop suddenly, together with the availability of replacement capacity should any of the load carrying capacity fail.

From their knowledge of operating economies of the individual plants connected to this system, the system dispatchers schedule the amount of capacity that must be available and the energy to be generated at each of the respective plants. to the end that optimum utilization and greatest economy can be obtained.

It will be noted from this exhibit, that on the high flow day, shown by the left-hand charts, the Holtwood and Safe

Harbor hydro plants were operating in the base of the load curve with the various steam plants operating above the hydro, the more efficient plants being nearer the bottom and the less efficient plants at the top of the load curve where they are used to produce the minimum amount of energy in relation to the amount of capacity operated.

The other two daily charts show the hydro energy being used in the top of the load curve.

On the average flow day, shown by the two center charts, the flow of the river is sufficiently high so that there is some hydro generation during each of the twenty-four hours, but most of the hydro energy was generated during the peak load hours where it can be most effectively used to reduce [I22] the use of steam capacity.

On the low flow day, shown by the two charts on the right of this exhibit, all of the hydro energy is in the top of the load curve, that is, the hydro generation is used during the hours of peak load requirements.

The three lower charts, one for each flow condition, show the amount of hydro capacity operated and the use of hydro generation on each day.

It will be noted that the hydro capacity has been effectively used on each of the three days, either for energy generation, as operating reserve capacity or spinning reserve; while at other times, such capacity is largely available as standby which will be referred to a little later.

Even with wide variations in river flow, the hydro capacity installed is fully utilized during the peak load hours of the system.

Q. What are the advantages to the customers of Penn Water and Safe Harbor of such coordinated use of the Hydro Companies resources? A. The advantages to Penn Water's customers are derived from (a) the installed capacity of the hydro plants; (b) the generation of hydro energy from the available river flow; and (c) the coordinated or joint use of the special facilities provided by these Hydro Companies.

With the maximum coordination of the hydro resources [123] with the steam resources of its customers, these customers derive several advantages.

First, such coordinated use reduces the amount of steam generating capacity required to be made available by the customers; who, thereby, have available for other uses, the money that would be required for such investment to carry their peak load requirements, including the necessary reserves.

Second, the transmission facilities of Penn Water and its Maryland subsidiary, S. T. Co. of Maryland, have reduced the investment requirements for transmission and distribution plant on the part of these customers.

Third, there is a resultant saving in the cost of fuel and other associated operating expenses.

Fourth, they obtain in general more economical operation of their own steam generating plant resources through the maximum use of their most economical plants and the minimum use of their less efficient generating equipment.

Fifth, a portion of the hydro capacity during low flow is available as reserve capacity to the customers' systems, without the latter having to incur the cost of keeping their boiler equipment banked and ready for service and the additional cost of running unneeded steam generating equipment.

Sixth, the ability of starting up hydro units from standstill to full load operation in a fraction of a minute [124] assures additional reserve capacity which, in connection with the use of the water stored behind the dam in the Safe Harbor pond for ready use, has been referred to as "A. C. storage battery service", and there are other advantages not specifically mentioned.

Q. Will you please describe more specifically the capacity service of these two hydro plants to the system?

A. Considering the hydro plants themselves, the capacity

that can be effectively used on the system load is determined by the effectiveness with which such capacity is used as limited by the available river flow.

The flow of the Susquehanna River has varied from a minimum seven-day average flow of 2,100 c. f. s. to a maximum flow of about 860,000 c. f. s.

The minimum flow of the river, together with the desired use of the water withdrawn from the storage above the two dams, generally determines, as a lower limit, the amount of energy which can be generated in a given period.

By using the two ponds as equalizing reservoirs, this generation can be distributed as desired and used only to supply the peak portion of the system requirements.

As can be seen by the right-hand charts on Exhibit 8, the sharper the peak portion of the daily load curve, the greater will be the hydro peak service capacity which can be supplied with a given amount of energy.

[125] The capacity value of the Holtwood and Safe Harbor plants to the combined system can be determined by considering the amount of steam capacity which would have to be installed to provide the same capacity service in the absence of the hydro plants.

In evaluating hydro capacity, recognition must be given to the load shape, to the probability of river flows, to maintenance schedules of the system capacity, and to the capacity reductions experienced in the different seasons of the year.

While such a capacity determination cannot be readily made from a single daily load diagram, it can be approximated by fitting the hydro energy into the peak load hours of the system load requirements for a group of consecutive days or weeks.

Q. Mr. Spaulding, in describing the use of hydro resources on the Susquehanna River, are you making a distinction between the capacity and the energy resources of these hydro plants? A. Yes, I am.

Q. Will you now describe the method of using the hydro energy in the most economical manner by coordinat-

ing the hydro with the steam resources of Penn Water's and Safe Harbor's customers? A. The energy available from the Holtwood and Safe [126] Harbor plants will vary with the available river flow supplemented on a daily or weekly basis by the use of pondage; that is, by the withdrawal of water from above the dams at the Holtwood and Safe Harbor Plants.

The economic value of such energy is measured in part by the amount of fuel and other operating expenses which can be saved at the steam plants of the hydro customers.

It is the responsibility of the Hydro Load Dispatchers, in cooperation with the system dispatchers of its customer companies, to schedule the use of hydro energy at times when it will replace the highest cost energy which would otherwise be required on the interconnected system.

The maximum overall system economy and reliability is always the objective.

There is greater possibility of operating savings when the hydro capacity is coordinated with the effective use of the steam capacity of a group of generating stations, or when the load requirements of several utility systems are combined.

Such coordination permits a wide selection of equipment and generating efficiencies with the result that the most efficient equipment can be operated to the best advantage and the operation of the least efficient can be minimized.

This, in a general way, is shown on Exhibit 8 where three component sources of steam generation have been fitted [127] into the system load requirements as would be done in day to day or weekly scheduling of loads and capacity, to obtain the maximum overall economies.

Q. In scheduling the operating of the various generating plants of the system, are you referring only to the generating plants of the Baltimore Company, of Potomac Electric Power Company and of Penn Water and Safe Harbor? A. No. There has been for fifteen years an appreciable

amount of interchange energy bought and sold by Penn Water over its northern interconnections in Pennsylvania on an economy basis, that is, energy is bought when the cost of such generation on another system is less than the cost of generation on our own system, and, similarly, our own energy is sold as interchange when there is an economic justification for so doing.

The contractual arrangements for such interchange provide for an equitable division of the savings in operation expense between the buying and selling companies in such transactions.

The effect of such interchange transactions is shown on the diagrams of Exhibit 8.

As stated previously, the heavy curved line graphically shows the system load requirements.

The dotted curve, which on certain occasions is above and sometimes below the solid line, graphically shows the actual system generation.

[128] Where the dotted curve of system generation is above the load requirements our system was generating power in excess of system requirements and was selling such energy as interchange to others.

The area shown below the solid line of system load requirements and above the dotted line of system generation represents energy purchased as interchange by Penn Water over its northern interconnections.

Q. In referring to available hydro energy for the combined system, you spoke of the use of pondage.

Will you explain this use further? A. The hydro peak service to this system, as illustrated on the right-hand diagram of Exhibit 8, depends on the use by these hydro plants of a quantity of water in excess of the actual flow of the river at the particular time the hydro energy is used in the system load.

Such operation is possible because the ponds above the Holtwood and Safe Harbor dams can be used as storage reservoirs to regulate the actual river flow over a